034115

PHOSPHORUS

Lambda User Controlled Infrastructure for European Research

Integrated Project

Strategic objective:
Research Networking Testbeds

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Collaboration Plan with US

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PP	Restricted to other programme participants (including the Commission	
RE	Restricted to a group specified by the consortium (including the Commission	
CO	Confidential, only for members of the consortium (including the Commission Services)	

Abstract

This deliverable outline the agreed framework for collaboration with the United States, Canadian and Japanese partners. The report will also include a detailed plan for short term research placements and common demonstration activities with these partners.

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1   Collaboration with non-EU partners

The main aim of the Phosphorus project is related to European partners co-operation however the full success can be achieved only by global collaboration of all interested partners. To fulfil this idea some non-European partners participate in the Phosphorus project: MCNC(USA), Nortel(USA), CRC(Canada). However, there are many others organisations working on dynamic service provisioning using network and computing resources. Partnership with them make opportunity of share the experience and technical knowledge, achieve synergy between all similar projects by collaboration in the common areas of interest. There is also possible to run some set of services between networks and solutions developed by different projects which is very practical kind of co-operation. Common meetings, demonstrations and workshops give a great possibility to promotion of the projects results in research communities.

The Phosphorus project will collaborate with the following organizations/projects:

- CANARIE,

- National LambdaRail/Enlightened Computing,

- Internet2/Dragon,

- Japan Gigabit Network/G-Lambda.

1.1   CANARIE Inc.

1.1.1   About CANARIE

It is Canada's advanced Internet development organization - is a not-for-profit corporation supported by its members, project partners and the Canada Federal Government. CANARIE's mission is to accelerate Canada's advanced Internet development and use by facilitating the widespread adoption of faster, more efficient networks and by enabling the next generation of advanced products, applications and services to run on them.

1.1.2   CAnet 3 and CAnet 4 networks
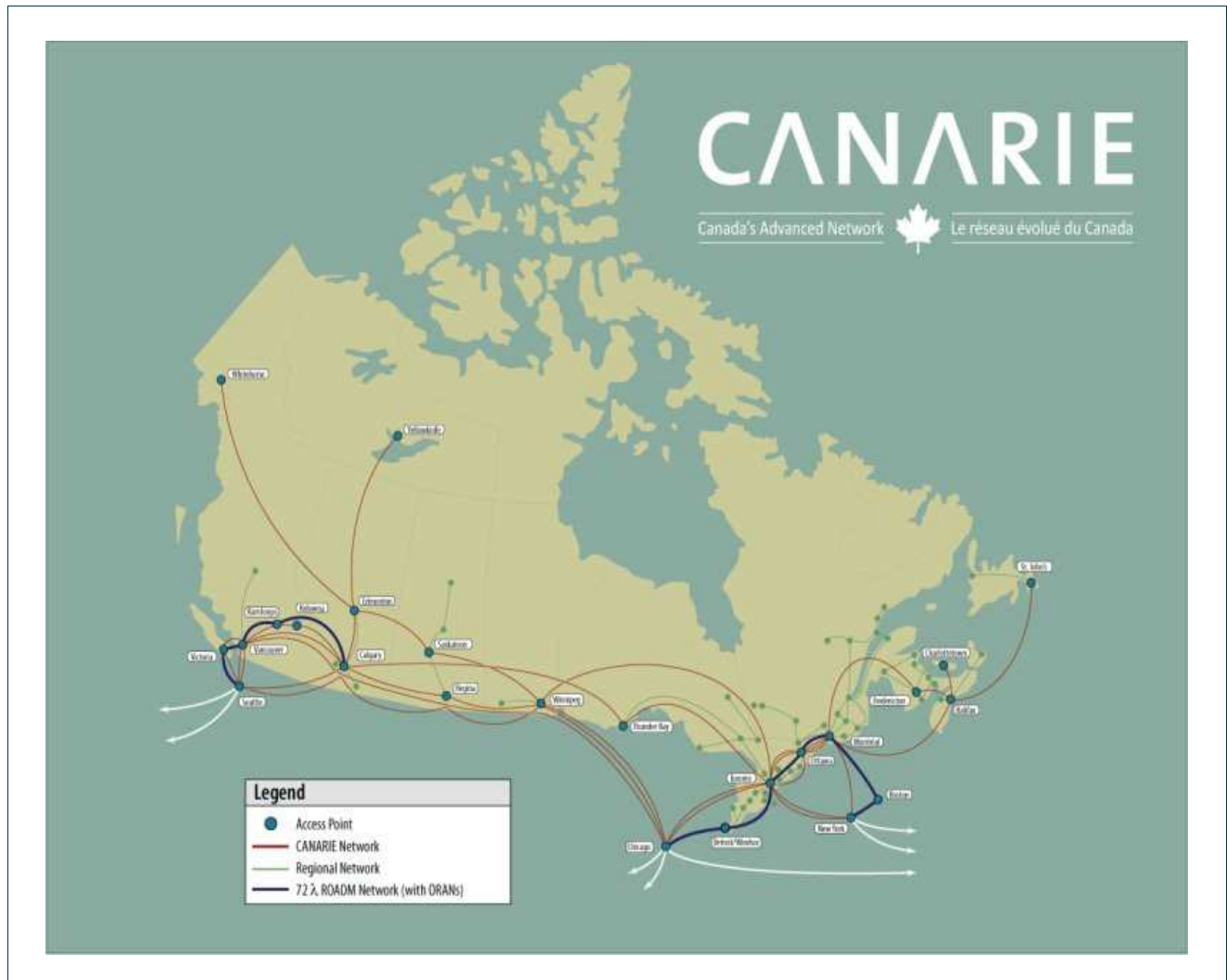
Figure 1.1: CAnet 4 network map

CANARIE has deployed CAnet 3, the world's first national optical Internet research and education network. CAnet 3 was among the most advanced in the world when it was built, and its design has since been replicated by many network operators, both in the research and education as well as commercial domains. Now, CANARIE is preparing a new network: CAnet 4. CAnet 4 (see Figure 1.2) will embody the concept of a "customer-empowered network" which will place dynamic allocation of network resources in the hands of end users and permit a much greater ability for users to innovate in the development of network-based applications. These applications, based upon the increasing use of computers and networks as the platform for research in many fields, are essential for the national and international collaboration, data access and analysis, distributed computing, and remote control of instrumentation required by researchers.

1.1.3 UCLP project
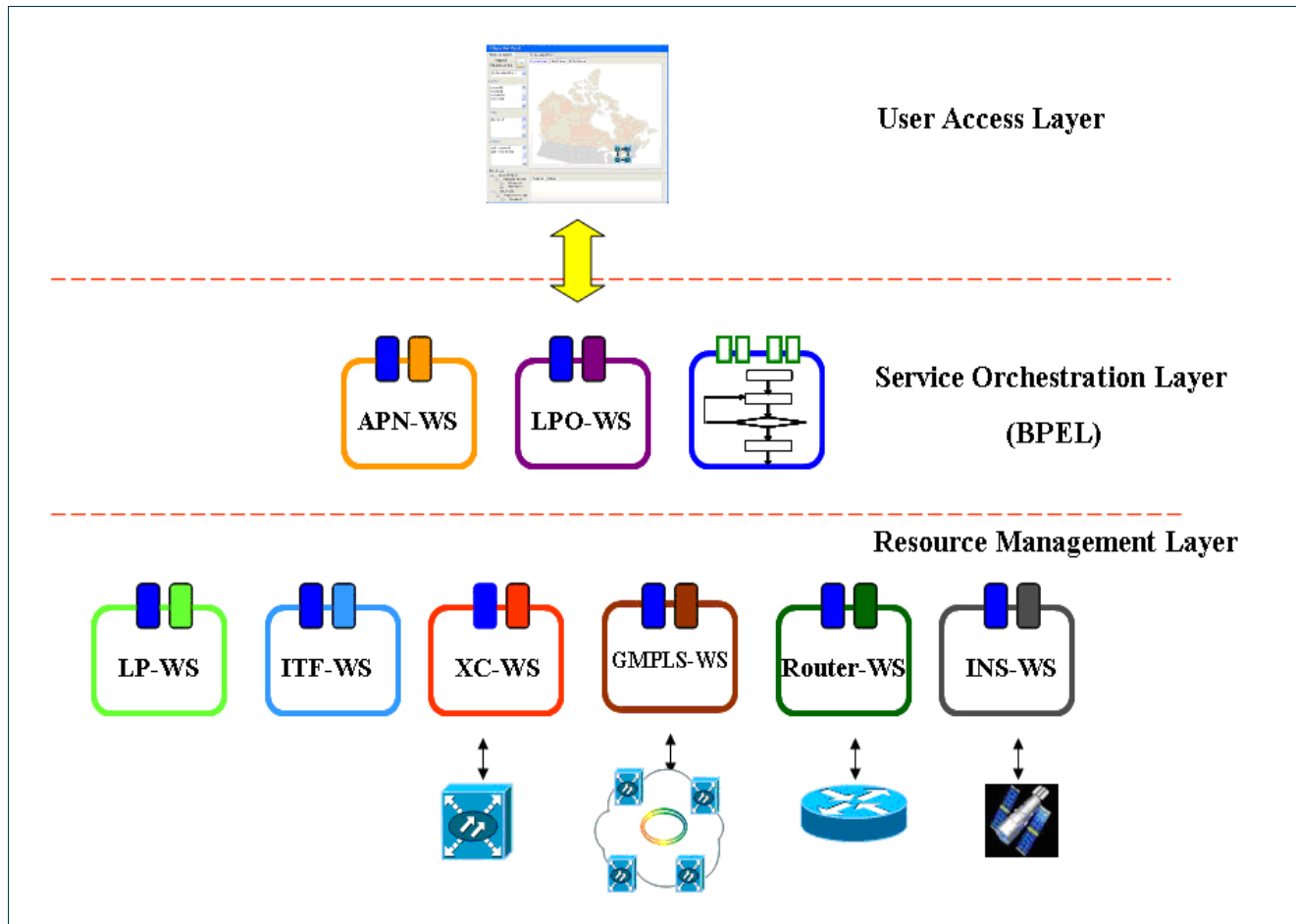
Figure 1.2: UCLPv2 System Architecture

One of the CANARIE projects is User Controlled LightPath (UCLP) which allows end-users, either people or sophisticated applications, to treat network resources as software objects and provision and reconfigure lightpaths within a single domain or across multiple, independently managed, domains. The UCLP architecture is presented on picture xx. Users can also join or divide lightpaths and hand off control and management of these larger or smaller private sub-networks to other users. The UCLPv2 project is funded under CANARIE's Directed Research Program and is being performed in collaboration with the Communications Research Centre, the i2CAT Foundation in Barcelona, Spain, Inocybe Technologies Inc., and the University of Ottawa. The goal of the project it to create a set of virtualized network resources that can be orchestrated into BPEL workflows to create Articulated Private Networks as described above. End users will be able to control and managed their APNs using a Graphical User Interface built on Eclipse RCP technology that is both familiar and very easy to use and will never have to see or write any BPEL workflow source code.

1.1.4 Eucalyptus project

Funded by CANARIE's Canadian Infrastructure Program, the goal of this project is to build a Service-oriented Architecture (SoA) for provisioning a set of heterogeneous resources, such as Videoconferencing tools, design applications, and networks elements, used by architectural design teams. Utilizing the UCLP tool on CAnet4, Eucalyptus allows architects and industrial designers at multiple locations to participate in real-time design sessions by simplifying their access and sharing of computational resources, geometry datasets, and rich multimedia content. Eucalyptus will provide university architecture staff and students in and with on-demand simultaneous shared access to visualization, modeling, and visual communication tools. The project will shed light on the value of intelligent network infrastructure to both application users and tool vendors. The emergence of SoA and UCLP herald the beginning of a new age where fully collaborative multi-site design may become the norm. The advanced network user community will benefit because the structure and function of the new lightpath-based Web Services developed for Participatory Design Studio may have other applications.

1.1.5 Phosphorus and CANARIE co-operation
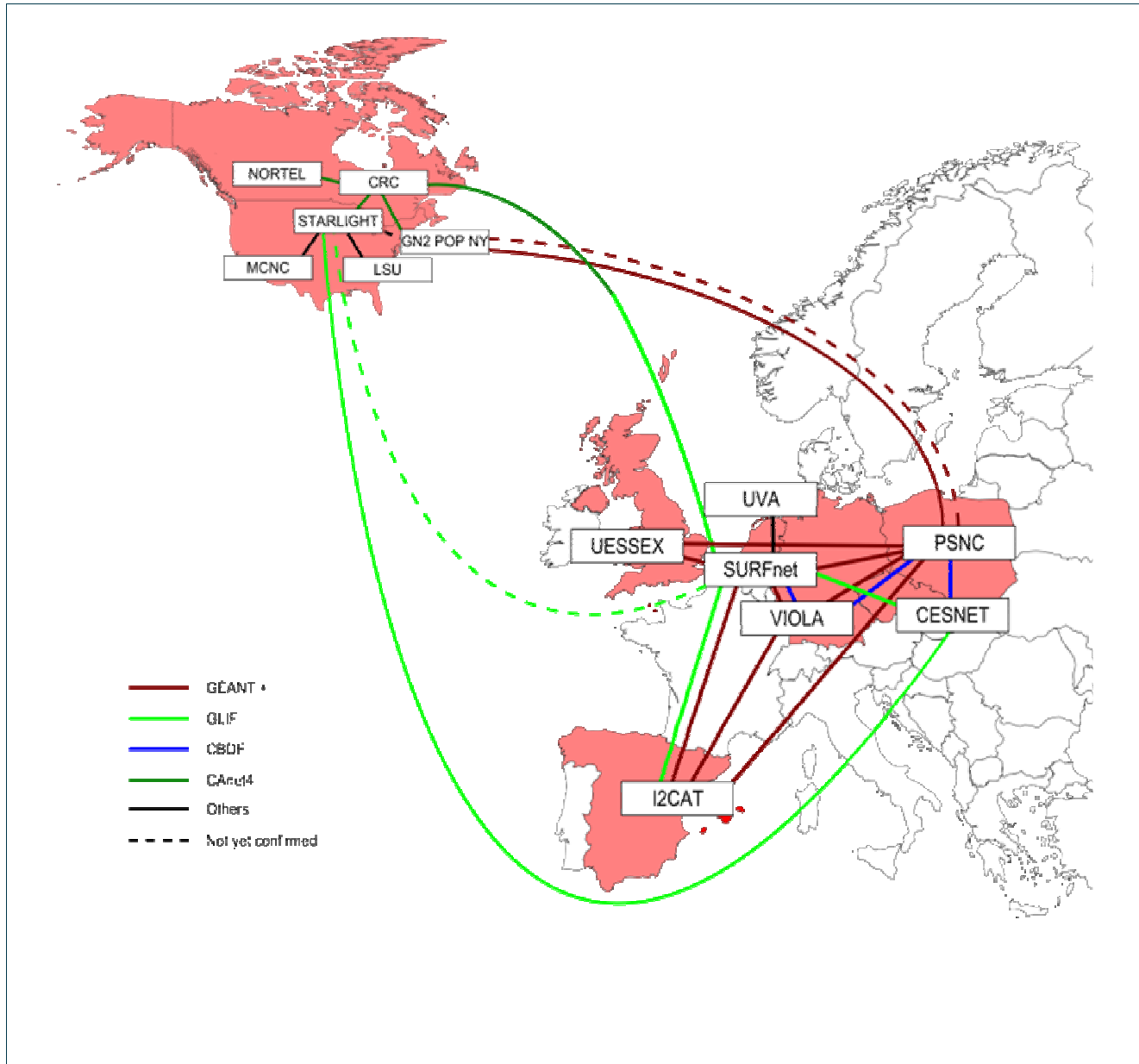
Figure 1.3: The Phosphorus testbed

Communications Research Centre(CRC) and i2CAT are participating in the Phosphorus Project and they are working on the UCLPv2 interaction to Phosphorus architecture aspects within Phosphorus WP1 activity. This work aims to create seamless interoperability between UCLP and DRAC, ARGON and GMPLS Control Plane. CRC and i2CAT will enhance of UCLPv2 to achieve the required Phosphorus functionality. To enable UCLP integration with other Phosphorus BoD solutions, the Phosphorus WP6 was discussing about a proper testbed

structure. Now there are appointed a few connections between Europe, Canada and United States presented on Figure 1.3.

Another co-operation point is using Eucalyptus in the Phosphorus project. The Phosphorus WP3 is responsible for adapting this application to Phosphorus demonstration purposes.

1.2   National LambdaRail/Enlightened Computing

1.2.1   About National LambdaRail network

National LambdaRail (NLR) is a high-speed national computer network (see Figure 1.4) in the United States that runs over fiber-optic lines, and is the first transcontinental Ethernet network. The name is shared by the organization of research institutions that developed the network, and, to date, plans to continue developing it.

It is primarily oriented to aid terascale computing efforts, but is also not intended to be a service network, but to be used as a network testbed for experimentation with next-generation large-scale networks. National LambdaRail is a university-based and -owned initiative, in contrast with Abilene and Internet2, which are university-corporate sponsorships. This gives universities more control to use the network for these research projects.



Figure 1.4: The NLR network map

Links in the network use dense wavelength-division multiplexing (DWDM), which allows up to 32 or 40 individual optical wavelengths to be used (depending on hardware configuration at each end). At present, individual wavelengths are used to carry a 10-gigabit Ethernet signal, although other systems such as SONET may also be used in the future.

1.2.2 Enlightened Computing project
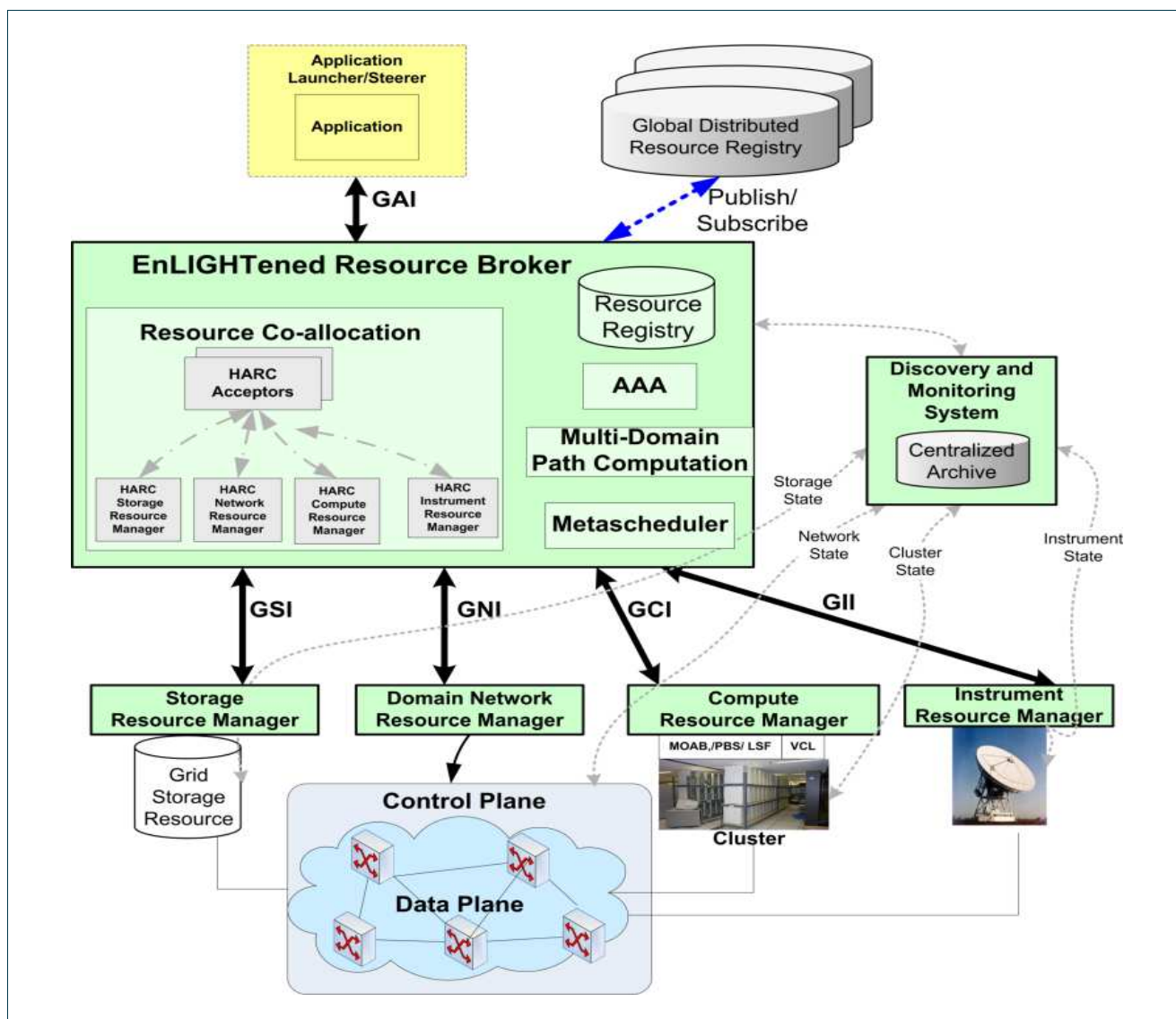
Figure 1.5: Enlightened Computing Architecture

The focus of the Enlightened Computing project is on developing dynamic, adaptive, coordinated and optimized use of networks connecting geographically distributed high-end computing resources and scientific

instrumentation. A critical feedback-loop consists of resource monitoring for discovery, performance, and SLA compliance, and feed back to co-schedulers for coordinated adaptive resource allocation and coscheduling (see Figure 1.5). Enlightened Computing network research is driven by concrete application projects in astrophysics, coastal modeling, and atmospheric research, currently underway, all of which critically require progress in network technologies and tools that utilize them. The research carried out, the developed tools, and the applications that use them will be deployed across regional and nationwide 10Gbps bandwidth testbeds running over National LambdaRail(NRL) and Louisiana Optical Network Initiative(LONI), connected via four all-photonic Calient switches, all using GMPLS control plane technologies.

1.2.3   Phosphorus and National LambdaRail co-operation

The one of the main participants of Enlightened Computing is MCNC which also is participated in the Phosphorus project and National LambdaRail organisation. MCNC (represented by Gigi Karmous Edwards) in the Phosphorus project will participate in testing and demonstration activities in order to extend the EU test-bed to the USA for international demonstrations for the Phosphorus project. This will increase the global awareness of the Phosphorus project and its developments. It will also provide very important exchange mechanism between the Enlightened Computing project and Phosphorus. The goal is be achieve interworking between Phosphorus and Enlightened networks in similar way as it was done between Enlightened and G-Lambda networks.

MCNC has also organised the Three Continents Meeting (2 February 2007) and hosted G-Lambda, Phosphorus and Enlightened Computing research teams for a face-to-face meeting to discuss collaboration plans.

1.3   Internet2/Dragon

1.3.1   About Internet2

Internet2 (University Corporation for Advanced Internet Development) is a non-profit consortium which develops and deploys advanced network applications and technologies, for education and high-speed data transfer purposes. Its goal is accelerating the creation of tomorrow's Internet. It is led by 208 U.S. universities and partners with 60 companies in areas from the networking (Cisco Systems), publishing (Prous Science) and technology industries such as Comcast, Intel and Sun Microsystems. Internet2 network is presented on Figure 1.6.

Figure 1.6: Internet2 network map

1.3.2 Dragon project

The DRAGON (Dynamic Resource Allocation via GMPLS Optical Networks) project, funded by USA National Science Foundation (NSF), is conducting research and developing technologies to enable dynamic provisioning of network resources on an interdoman basis across heterogeneous network technologies. A DRAGON network architecture and control plane is defined which aims to leverage the maturing of network technologies (such as WDM, Ethernet, and Next-Generation SONET) to demonstrate the power and flexibility of a "hybrid" packet and circuit switched network infrastructure. A key element is the extension of the GMPLS IP control plane to enable multi-domain, multi-layer, multi-service provisioning with robust levels of authentication, authorization, and accounting. DRAGON's architecture is presented on Figure 1.7.
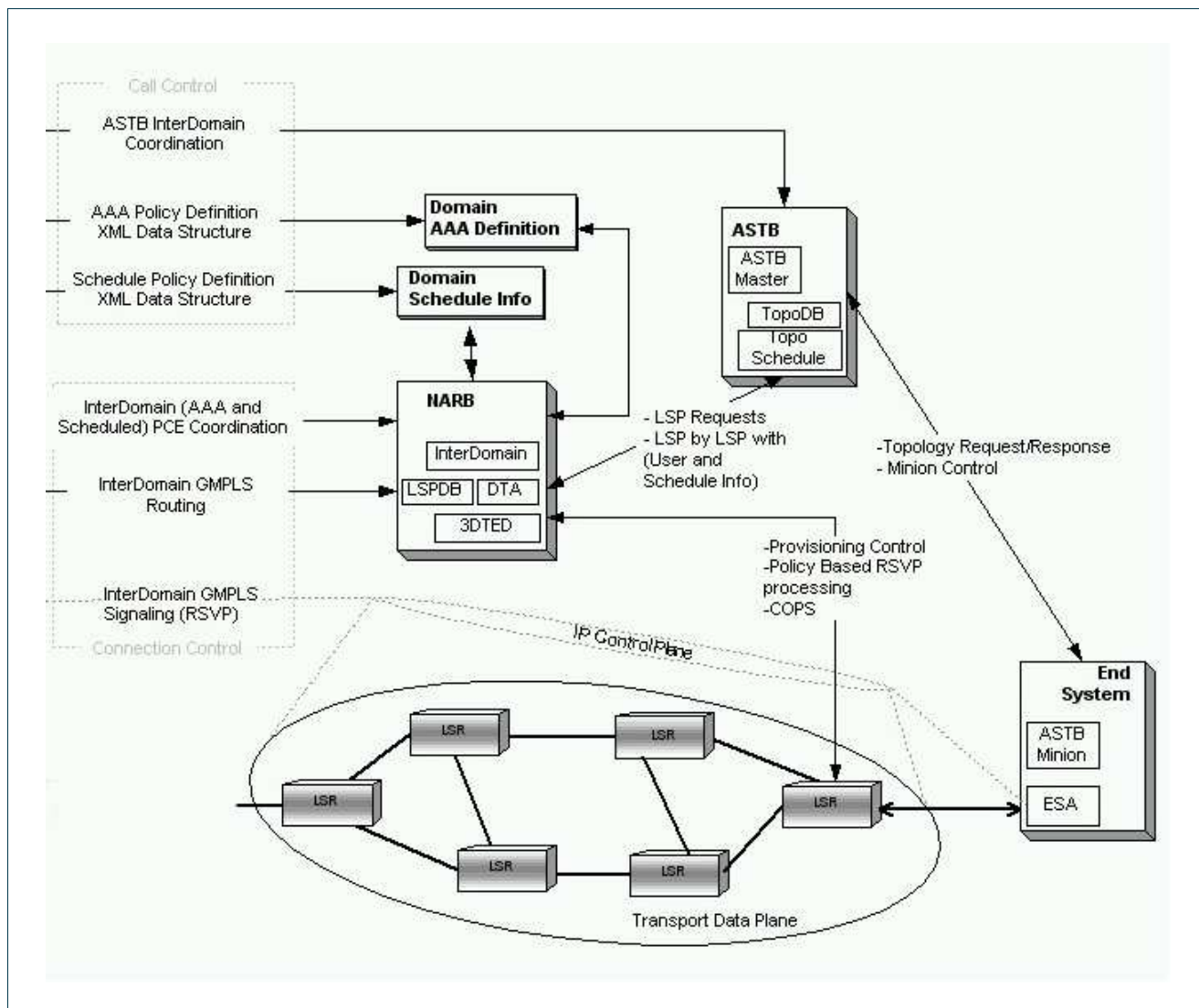
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Figure 1.7: Dragon's architecture

1.3.3   Phosphorus and Internet2 co-operation

Co-operation is focused on creation common Authorization, Authentication and Accounting mechanism with collaboration of Cees de Laat (University of Amsterdam) who is developing a Generic AAA Toolkit. The Generic AAA Toolkit components are applied to drive the authorization necessary to perform end-to-end provisioning of network connections across multiple administrative domains. Generic AAA components can be driven by grid middleware components via various interfaces including web services style interfaces that adhere to the Open Grid Service Architecture (OGSA). This is work of Phosphorus WP4.

There will be also a Phosphorus presentation during Internet2 Day Event on 23 April 2007.

1.4   Japan Gigabit Network/G-Lambda

1.4.1   About Japan Gigabit Network

Japan Gigabit Network (JGN) is a nationwide, next generation, high-speed telecommunications network that is made widely available for use at Japan universities, research institutions, venture businesses, local governments. The JGN is expected to be widely used for research and development of very high-speed networking and high-performance application technologies. The JGN is also expected to create business opportunities and telecommunications services.

1.4.2   G-Lambda project

The goal of G-lambda is to establish a standard web services interface to network resource manager provided by network operators (Telecom operators). This interface should be used by application service providers (Grid resource managers / Grid brokers) or by end users to make the most of network operators service available. Define a standard web service interface, which is acceptable for both ASP and commercial network operators (see Figure 1.8). G-Lambda optical testbed was established using JNG network.
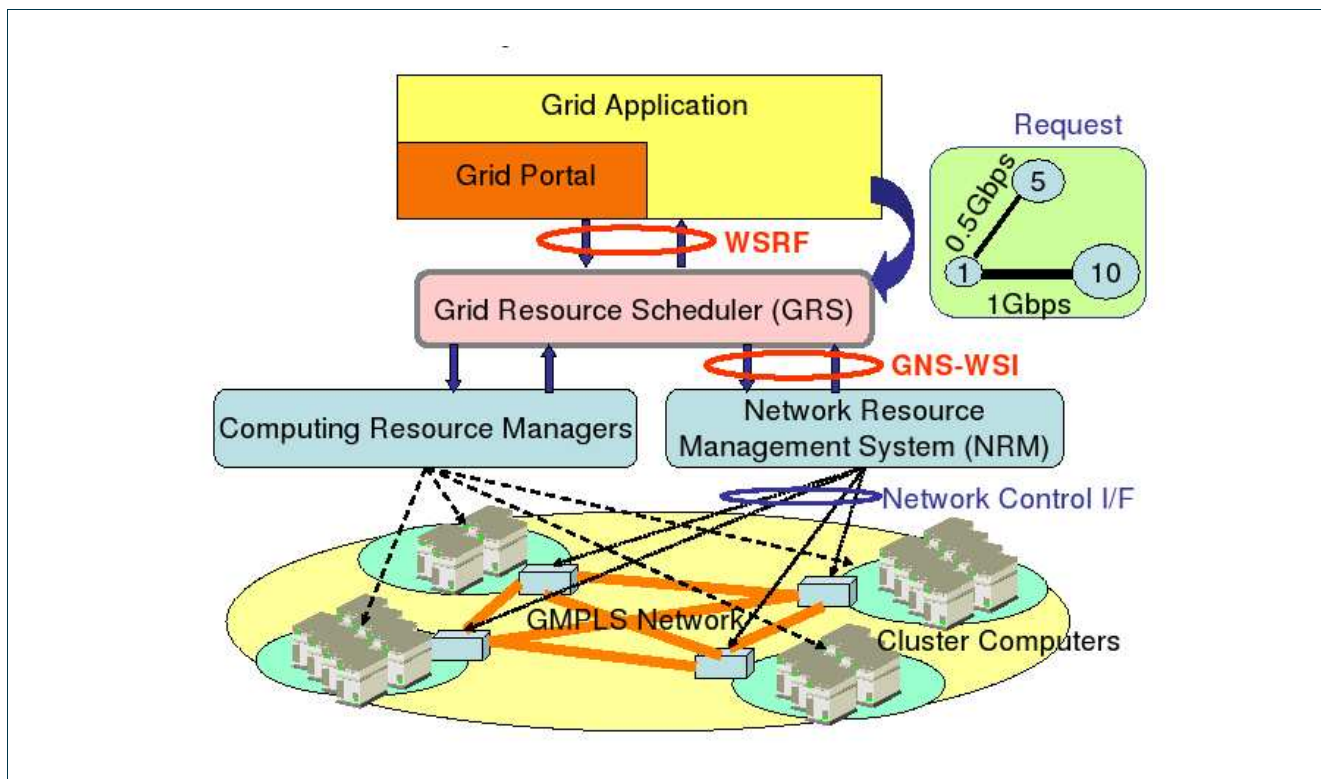

Figure 1.8: G-lambda's system overview

1.4.3 Phosphorus and G-Lambda co-operation

The main goal of this co-operation is to establish standard and open interfaces which can be used for connecting different Bandwidth on Demand system components especially preparing a connection between G-Lambda and Phosphorus testbeds and demonstrating together an advance network and computing service delivery demonstrations.

2 Collaboration Across Three Continents Meeting

From January 31st to February 2nd 2007, MCNC was be hosting G-Lambda, Phosphorus and Enlightened Computing research teams (see Figure 2.1) for a face-to-face meeting to discuss collaboration plans. During this meeting all participants gain an understanding of the three research project, established a work plan for 3-way collaboration.

Figure 2.1: G-Lambda, Phosphorus and Enlightened Computing research teams

Collaboration Plan with US

The goal of this event was to allow these three teams to formulate an action plan for collaboration of optical networks and grid middleware across three continents:

- Develop two common interfaces to request resources:

  - An API for all grid resources,

  - An API to request Lightpaths from domain network managers,

- Interconnect all testbeds.

The collaboration between all three project will be presented during demonstrations events. During 2007 it will be possible on GLIF meeting (7th Annual Global LambdaGrid Workshop, 17-18 September 2007, Praha) and Supercomputing meeting (SC'2007, 10-16 November 2007, Reno). The Phosphorus project will take effort to prepare a testbed before this demos and will also present some applications.

3 References

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